UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MARCH 5, 1992

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

SUBJECT: Clarification of “Catastrophic” Leak Detection Requirements for UST systems with pressurized Delivery Lines

FROM: David W. Ziegele, Director
Office of Underground Storage Tanks

TO: Regional Program Managers
Regional Branch chiefs

It has been brought to my attention recently that some confusion exists within the pipeline leak detection community regarding whether or not EPA requires quantitative annual performance tests of mechanical and electronic line leak detector. (“LLDs”) on all pressurized piping at UST sites. Section 280.44(a) of the UST technical rules requires owners and operators to test the operation of all USTs annually in accordance with manufacturer requirements. The same section of the rules also cites the need for such devices to detect leaks of 3 gallons per hour (gph) at 10 pounds per square inch (psi) within 1 hour. The purpose of this memorandum is to clarify what kind of annual test must be performed on LLDs under the rules.

The question of what constitutes an annual equipment test is an important one, because we estimate there are somewhere between 500,000 to 750,000 pressurized lines at UST sites nation-wide. This issue was initially addressed in an August 12 memo prepared by Randy Nelson, Region VII, with the cooperation of David Wiley from OUST, that was distributed to all the Regions (see Attachment I). However, they both attended a November 18-19 ASTM meeting in Kansas City on pressurized line testing where it was obvious that while all in attendance had seen Randy’s memo, some members of the leak detection provider industry still persisted in their contention that EPA requires (or at least should require) a once-a-year quantitative performance test of all LLDs in the field.

Provided with this memorandum im a brief technical analysis of the rule's leak detection requirements for pressurized lines (Attachment II). I believe you will agree that it reflects our original intentions during promulgation of the technical requirements for line leak detectors. It also supports with Randy Nelson's earlier interpretive findings in this area, that:

(a) Any model of LLD installed after September 22, 1991 must have been evaluated according to EPA's standard test procedure. The evaluation, usually performed by a third party, must find that a typical out-of-the-box LLD is able to detect, at a minimum, a leak at 3 gph at 10 psi within 1 hour, with a probability of detection of 95% ant a probability of false alarm of 5%.

(b) The annual test of the LLD is an operational, as opposed to quantitative, verification that the LLD is functioning in the piping system. The annual test is not intended to show compliance with the above evaluation performance standard. There are no quantitative or performance test requirements for an installed model of LLD that passed the evaluation. The annual test should be performed to assure that the LLD is installed in the line properly, not being tampered with, being maintained, and operating within the manufacturer's specifications.

We found some good news in the compilation of some recent pressurized line tightness testing data which suggests that when the regulatory approach we promulgated (and further explain in this paper) is complied with, it appears to be having the desired positive effect in protecting human health and the environment: properly managed pressure lines are leaking less than 0.5 percent of the time, usually at substantially less than 1.0 gals/hour. This is a vast improvement over the 10 percent leakage frequency and the too frequent catastrophic leak rates reported prior to final rule promulgation.

Unfortunately, even in the face of such good news, some service providers in the leak detection community continue to argue the need for annual, in-the-field quantitative performance tests of all LLDs. At this time, I do not see any need for such tests.

In response to the present confusion, I intend to share the findings shown on the attachments with the wider leak detection community. Towards that end, I am mailing a copy of the attached analysis and rule interpretation to each of the three providers of mechanical line leak detectors. Also, I am providing this information to Bob Renkes, Executive Director of the Petroleum Equipment Institute, for summary in PEI's TulsaLetter. We have prepared an Environmental Fact Sheet (Attachment III) summarizing the issue and we are sending copies according to our standard distribution.. If you have requested that materials go through you, please pass on the enclosed copies of the fact sheet to your state contacts

If you have any questions about this letter please Contact David Wiley at (703) 308-8877 or Randy Nelson Region VII at (913) 551-7220.

Attachments

cc: Roy Bennett, President
Vaporless Manufacturing Inc.

Robert L. Besson, President
The Marley Pump Company

Gene Mittermaier, Manager, New Product Development

Tokheim Corporation

Bob Renkes Petroleum Equipment Institute

bcc: John Van Daele
Tokheim Corporation

AUGUST 12, 1991

MEMORANDUM

SUBJECT: A Technical Update on “Catastrophic” Line teak Detectors and the UST Regulations

FROM: Randy Nelson, Senior Environmental Engineer,
State Programs Sections, EPA Region VII

TO: Distribution List

It has recently been brought to our attention that there is presently a great deal of contusion about how EPA's release detection regulations for underground storage tanks (USTs) apply to the “catastrophic” line leak detector (LLD) that must now be in place on all pressurized lines attached to USTs. Widespread confusion about how to interpret EPA’s requirements as they apply to LLD’s has been reported among manufacturers, owners, testers, and the state regulators. This brief memo is intended to clarify and update you on the Office of Underground Storage tank’s (OUST) regulatory interpretations and recent activities on this subject. This information has been developed in cooperation with OUST.

Statement of Problem

A major source of the confusion about LLD’s and their associated EPA requirements appears to stem from the fact that several line tightness testers are now reportedly offering and providing services in the field that not only test the tightness of pressurized lines (at the 0.1 gals/hour minimum leak rate on an annual basis as required by the regulations) but also to test the leak threshold performance capabilities of the catastrophic LLDs at the site. There appears to be a wide-spread <u>but incorrect</u> belief that <u>EPA regulations require</u> such field performance testing of the LLDs at the time of the required annual tightness test of the lines. The UST regulations require that the performance of the LLDs be checked annually in accordance with the manufacturer’s requirements.

Summary of EPA's Requirements for LLDs

Very simply, EPA’s regulations in 40 CFR Part 280 Subpart D require that LLDs must be:

(a) installed on all pressurized piping that connects to an underground storage tank (see 280.41(b)(1));

(b) operational and functional and capable of detecting a catastrophic leak, including an annual test <u>in accordance with the manufacturer’s requirements</u> (see 250.44(a); and

(c) certified by a third party testing organization to be able to perform “out of the box” to EPA’s standards of 3 gph at l0 psi, with a probability of detection of 0.95 and probability of false alarm of 0.05 if the LLD is installed after September 22, 1991 (see 280.40(a)(3); 55 Federal Register 26, published January 2, 1991; and EPA's recommended line leak detection evaluation protocol).

Discussing each of the above points in turn:

Federal Regulations require line leak detection on all pressurized piping from underground storage tanks. The most popular type of LLD is designed to test the piping for a large leak every time a submersible pump is turned on and off. If the line is leaking, the LLD will restrict flow from the pump and/or sound an alarm alerting the attendant there is a problem with the piping.

The LLD must be in place and in working order and its intended function must not be altered In any way. The functional element of the LLD must be active and have the ability to sound an alarm or restrict the flow of product in the pipe if a leak is detected.

An LLD installed after September 23, 1991 must have had its leak detection ability evaluated and certified by a third party according to an accepted protocol for LLDs. Manufacturers of LLDs are responsible for obtaining the certification and the quality control of subsequently manufactured LLDs. A new LLD (out-of-the-box) must be capable of detecting a 3 gallon per hour leak at 10 psi with a 95% probability of detection and a probability of false alarm of 5%. Once a LLD is installed in the field there is no EPA rule requiring a test to determine if the LLD can detect a 3 gallon per hour leak, but the LLD must be checked on an annual basis in accordance with the manufacturer's instructions.

The Unsettled Issue of LLD Field Performance

The EPA is presently gathering and reviewing pressurized line testing data to examine if perhaps routine field testing of the LLDs detection threshold may be necessary to protect human health and the environment and, if so, what is the minimum level of detection that a field-installed LLD must be capable of demonstrating in a field performance test. Unlike some of the other regulated portions of an UST system, LLDs have moving parts that are subject to wear that may cause degradation of the LLD's performance over time. It is simply not clear to EPA at this time what level of degradation in the field will cause LLDs to not catch the "catastrophic" types of Leaks that occurred in the past at UST sites (and that we are trying to regulate). Therefore, OUST is conducting a quick field study of this question that includes the collection of line leak performance data and interviews of experience field personnel.

Based on the results from this on-going study, OUST will provide further guidance in the future about the level of detection an installed LLD must be capable of detecting in the field. Some possible options include proposing EPA regulatory changes; turning to consensus code making bodies (such as ASTM or PEI) for standard-setting assistance; or simply continuing with the current requirement of annually checking LLD field performance "according to the manufacturer's requirement". The latter approach (no action), for example, would be protective of human health and the environment if the study results show that catastrophic line leaks are typically manifested in a way that will be quickly detected, even by equipment that has degraded through use overtime.

Caution About Evaluation of LLD Field Performance

The equipment currently being used to test and evaluate the performance of LLDs in field has generally not been scrutinized by EPA or a consensus code making body. Therefore, the results of voluntary tests of this nature should be viewed with caution. Many of these field-test-devices have been designed and utilized on an ad-hoc basis to evaluate LLD performance but have not been shown to reliably accomplish this task according to some independent or established consensus guideline (most likely because-no guideline exists that we know of). EPA will be discussing the need for such guidelines with appropriate code making bodies after the above-mentioned EPA study is completed.

If you have any questions about the above technical information please contact me at, Region VII, FTS 276-7220, Dave Wiley, OUST, at FTS 398-8877, or Joe Womack, Region VI, at FTS 255-6755. These are the EPA employees on the line leak detection team working on this issue

cc: EPA Regional UST Program Managers

ATTACHMENT II

Automatic Line Leak Detectors Paper

1. What are (Catastrophic) Line Leak Detectors (LLDs)?

2. Background/Purpose of the LLD Requirement

3. The LLD Performance Standard (3gph/10psi @95 &05)

4. Annual Test of the LLD's Operation

5. Summary/Conclusions: “So What is Required by EPA?”

Appendix I - Data and Analysis

Appendix II - ASTM Efforts

1 <u>What are (catastrophic) Line Leak Detectors (LLDs)</u>?

The following description was provided by the American Petroleum Institute in their July 15, 1987 comments on the proposed rule. It is repeated here because it is a good summary of the flow-restrictor type of LLDs:

"Mechanical Line Leak Detectors (MLLDs), which work in the following manner. When the dispenser is activated product flows through the detector at a rate of 1.5 to 3.0 gallons per <u>minute</u>. This causes the pressure in the pipe to increase rapidly to 8 to 10 psi. This increase in pressure actually pushes the valve in the leak detector toward a <u>shut</u> position, restricting the flow to a rate of 3 gallons per <u>hour</u>. If there is a leak in the system of 3 gph or greater at 10 psi, then the pressure will not increase further and the flow will remain restricted. If there is a leak of lesser magnitude, then the pressure will build slowly, though it will eventually reach full operating pressure. If the system is tight, then the pressure will increase rapidly. As the pressure goes above 10 psi, the valve is forced to its fully open position, and the system is in operation. The valve remains open until the pressure in the line drops below 1 psi."

Since the time the rule was formulated, electronic LLDs have emerged in the market. Though electronic LLDs are not subject to the same types of wear and tear as mechanical devices, the following discussions cover all LLDs.

(b) <u>Background/Purpose of the LLD Requirement</u>

As stated in the preamble to the final rule (53 fed. Reg. 37153 (1988)), LLDs were required by EPA in the belief that their use which eliminate 80 to 95 percent of the volume of releases occurring from underground piping at UST sites. As stated in the EPA <u>Causes of Release</u> report done in support of the final rule, the consensus from the field experts was that releases from pressurized lines without LLDs can result in large, “overnight” catastrophic releases that typically range in size between 600 and 6,000 gallons. Also cited in the report was a meeting with nine experienced installers who could together easily recall over one hundred and fifty such incidents. While the field experts were not sure exactly how LLDs functioned, they did observe that they successfully detected catastrophic leaks, particularly if the device was kept in operating condition and was checked periodically so that its use was not tampered with or overridden by the UST owner or operator. These claims were corroborated by numerous other commenters. EPA's faster phase-in of the use of LLDs in the final UST rule was intended to curtail these catastrophic, or run-away, releases from pressurized lines.

The use of LLDs was also anticipated by some commenters as having the added benefit of detecting and enabling curtailment of releases even much smaller than 3 gph. One commenter (UST2-1-CO-413A) provided calculations showing how even relatively small leaks (significantly less than 3gph) will noticeably extend the LLDs cycle time in its test (flow restriction) mode well beyond the normal cycle of 2 seconds, particularly when beginning to first operate the pressure line system each day. These delays are noticed by customers who alert the UST owner that there may be a problem in the line. One very experienced contractor (UST2-3-SB-45) estimated that LLDs would cause detection of over 80% of the leaks in pressurized lines in this manner. Many of these commenters agreed with the Agency's final rule decision to back up LLDs with a more rigorous once-a-year line tightness test to catch the rest of the smallest leaks.

In sum, the general consensus was that LLDs are crude but effective devices for curtailing catastrophic releases from pressurized lines, provided they are periodically checked and assured to be in operating condition. There were some questions about how these devices worked, but very little doubt expressed about their ability to detect catastrophic leaks early, provided they are maintained in good working order.

(c) The LLD performance Standard
(3gph/10psi @95/05)

As discussed in the final rule's preamble and the summary and response document, several commenters stated that line leak detectors that restrict flow of product were unable to meet the proposed 2 gph criterion. Based on an evaluation conducted by EPA'S office of Research and Development and a commenter-supplied evaluation of several LLDs, the Agency established the standard as 3 gph at 10 psi, with a probability of detection of 0.95 and a probability of false alarm of 0.05. At the tine of final rule, method providers did not have a means to obtain this type of performance information for each method. Thus, the 95/05 portion of the standard was delayed for two years. In effect, method providers were given 2 years to develop method-specific performance data and, if necessary, modify their methods so that they could meet the EPA standard.

EPA completed and distributed a final method performance evaluation protocol, titled Standard Test procedures for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems, in October 1990. The compliance date on the 95/05 portion of the standard was pushed back by EPA 270 days (or until September 22, 1991) to enable method providers to evaluate and distribute method-related performance data using the standard results-reporting sheets in the recommended protocol (56 Fed. Reg. 24 (1991)). As stated on page 2 of the protocol, the performance estimates that result from conducting the protocol on a particular method enable them to be easily compared to the technical standards prescribed in the EPA final regulation. Similar to the other protocols, the recommended evaluation for piping detection methods “is not designed to determine the functionality of the system (i.e., whether it operates as intended), nor is it meant to assess either the operational aspects of the system (e.g., the adequacy of the maintenance and calibration procedures) or the robustness of the system." In other words, for each method it is a one-time, out-of-the-box test on a representative piece of equipment. It does not have to be repeated on each new piece of equipment built at the factory to the same specifications.

4. Annual Test of the LLDs Operation

Section 280.44(a), in addition to stating the 3 gph/10 psi performance standard, also requires "an annual test of the operation of the leak detector...conducted in accordance with the manufacturer's requirements." The final rule's preamble points out (on page 37167) that this requirement was added in response to commenters' concern that line leak detectors can "malfunction or be overridden by unwise operators." The Agency's supporting summary and response to comments document (page 12-5) further identifies these commenters' concerns that there is a need for such maintenance checks because of "the possibility that the equipment could fail or that operators could shut them off." Some of the specific concerns cited by commenters included:

(a) "our experience is that many operators disconnect these devices because of the fear of offending customers should the device trip and restrict flow... (inspection) will insure operational integrity... to see if they are working." (UST2-3-CO-56)

" "An annual check to determine if the LLD is functioning properly..." (UST2-3-CO-62)

" "It is our experience that if LLDs are not maintained annually, then a significant percentage will fail to function as designed." (UST2-1-PHC-3-A)

" "...to ensure that they are in working condition." (UST2-3-LC-26)

" "A simple self test... to determine that the internal circuitry and overall unit remains functional..." (UST2-3-CO-19)

Most of these commenters also expressed reservations about EPA establishing a performance standard for LLDs and certainly did not express the need for an in-the-field quantitative performance check. A check for equipment operability, to determine if it was turned off or otherwise tampered with was clearly what these commenters had in mind. Is it hooked up and in working order? Has it been circumvented by the operator? Is it broken? These are questions meant to be answered by EPA's required annual test of the equipment's operation. The fact that some line tightness testers now claim to have developed various methods for conducting quantitative measurements of equipment performance in the field is an interesting and potentially valuable improvement in technology. However, it is not something required by EPA's annual test of the operation of LLDs.

Summary/Conclusions: "So what is required by EPA?"

As provided in more detail on page 23 of OUST's "straight Talk on Tanks," each pressurized piping run must be equipped with an automatic line teak detector, backed up by an acceptable monthly detection method or an annual line tightness test (conducted at 0.1 gals per hour).

All automatic line leak detectors, including mechanical and electronic, must be able to detect a leak of at least 3 gph at a line pressure of 10 psi within one hour. All LLDs installed after September 22, 1991 must also be able to meet the more stringent EPA requirements for detection performance (a probability or detection of 0.95 and a probability of false alarm 0.05). Demonstration of compliance with the performance standards (and the statistical probabilities of performance) can be accomplished by a one time test conducted on a typical piece of equipment "out-of-the-box" using the recommended EPA evaluation protocols. It is EPA's understanding that all the major manufacturers of line leak detectors are able to provide proof of such performance to all UST owners and operators using the major methods now on the market.

The operation of all automatic line leak detectors must also be checked once a year. This test must assure that the equipment is properly installed in the line, is not tampered with or being bypassed, and is not broken or otherwise outside of the specifications/requirements provided by the method's maker.

Annual quantitative performance tests of each piece of equipment installed in the field are <u>not</u> required by EPA's standards. such tests are voluntary, and once standardized, may become a good industry practice. However, such field test results that indicate more than 3 gph LLD performance on a line in the field do not necessitate automatic equipment replacement under the EPA requirements. Manufacturer requirements should be followed to determine if the equipment is actually broken and operating outside of the equipment's normal range of tolerances and specifications. For example, if a LLD fails to detect a 3 gph leak at 10 psi, but detects a 4 gph leak at 10 psi the owner is in compliance with EPA regulations, provided the owner is in compliance with the manufacturer's requirements.

Recent data collected by EPA from some 3,500 line leak tests (tee appendix I) indicated that LLDs properly applied in accordance with the above EPA requirements appear to ha doing the job they were intended to do: eliminating catastrophic leaks and causing earlier detection or smaller leaks (through noticeable, extended equipment cycling times).

Appendix I - Data and Analysis

Overview: In the fall of 1991, five companies which test pipelines and mechanical line leak detectors (LLDs) provided recent data from approximately 3500 separate tests from around the country. The vast majority of LLDs installed are "Red Jackets," manufactured by Marley Pump.

Conclusions on the sample data:

Pressure pipelines

- Less than 1% of lines were reported leaking.
- Size of leaks: either less than 0.3 gallons per hour at approximately 50 pounds per square inch, or so large as to be "unable to hold pressure".

LLDs

- There is a wide variation in the rates of rejection in the field of in-service (vs. new) mechanical LLDs depending on the equipment and procedures used. Red Jacket Piston Leak Detector reject rates vary from 5% to 54%.
- During annual field performance tests, a large number of Red Jackets fail at 3 gph at 10 psi, but pass at 4 gph at 10 psi (31% in one survey of 605).
- Out of 1 tester's 59 rejected LLDS, only 1 LLD failed to actuate at flowrates greater than 8 gph @ 10 psi. Most failed to trip between 6.0 and 7.0 gph.

Inferences on the population as a whole:

Pressure pipelines

- Line leaks in range of 1.0 gph to 10.0 gph at line pressure (~30 psi) are rare. Either lines "weep" or they leak at much higher flowrate.

LLDs

- LLD performance degrades to values above 3 gph @ 10 psi, but not beyond 8.0 gph. They wear down, but not out.
- Wide variation in failure rates among test methods could be reduced if testers' equipment and procedures adhered to an industry standard.

Appendix II - ASTM efforts

An industry advisory task force has formed to study the subject of catastrophic underground pipeline leak detection, and to recomend an approach for testing line leak detectors (LLDs), This group is under the auspices of ASTM Subcommittee on Storage Tanks (E-50.01), and was formed in response to concerns over the wide variation in the way mechanical LLDs are flow tested in the field. Such field testing is currently not covered by either an EPA protocol or a nationally recognized consensus code. The work product(s) of this task force could serve as the basis for an ASTM approved standard.

The ASTM task group membership includes manufacturers of mechanical and electronic LLDs, experienced end users, testers, consultants, and EPA. The group has agreed to concentrate on basic technical requirements and on the variables (such as viscosity, temperature, piping, bulk modulus, etc.) encountered in the field in testing the performance of LLDs. For example, a method should be able to test a LLD <u>in</u> the line, as well as out of the line. The group will <u>not</u> address either the field test performance standard (which EPA has been asked to clarify) or LLD design and test procedure details (which must be left up to manufacturers).

If an ASTM Standard is approved, it could be used by manufacturers and testers as the minimum technical requirements that their specific testing equipment and procedures must meet when evaluating LLD performance in the field. The potential benefits of an such a Standard are several A practice on this subject will, at a minimum, promote a nationwide consistency of field testing among all methods and thereby provide comparison of equipment performance as well as an empirical basis for further equipment improvement. Since this effort addresses <u>how</u> testing is done, it is separate from EPA's clarification of <u>what</u> regulatory standard testing must meet.

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